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NEUROPSYCHIATRIC ORGANIZATIONS IN THE GERMAN AIR FORCE

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COMBINED INTELLIGENCE OBJECTIVES
SUB-COMMITTEE

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NEUROPSYCHIATRIC ORGANIZATIONS
IN THE GERMAN AIR FORCE

Reported By:

W/C DENNIS WILLIAMS
Air Ministry

CIOS Item No. 24
Medical

COMBINED INTELLIGENCE OBJECTIVES SUB-COMMITTEE
G-2 Division, SHAEF (Rear) APO 413

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REPORT ON C.I.O.S. TRIP NO. 277. 25th MAY - 4th JUNE, 1945

Neuropsychiatric Organisations in the German Air Force

by

Wing Commander Denis Williams

Introduction

Many of the interviews upon which this report is based were held jointly with Major Leo Alexander, U.S. Army M.C. and Major George Smyth, R.A.M.C., who are presenting separate reports. I am grateful for their help, especially in interpretation.

Air Crew Psychiatry and Psychology

Informants

Professor Dr. Luxemberger. Consultant Psychiatrist to the Luftwaffe, late professor of psychiatry, University of Munich. Seen at an evacuated Luftwaffe hospital at Possenhoffen, in the Starnbergersee, Bavaria.

Dr. Siegfried Gerathewohl. Late Senior Psychologist to the Luftwaffe, in charge of an Aircrew Selection centre. Interviewed in Kreuzegg, Garmisch.

Corroboration from Oberstarzt Lorentz - Senior physician and administrator (P.M.O.) of a Luftgau, Dr. Richard Lindenburg, Stabsarzt, interviewed at the Kaiser Wilhelm Institut, Munich and Dr. Düssik, Stabsarzt, assistant to Generalarzt W. Tönnis, earlier M.O. at an E.F.T.S.

Co-operation was in all cases excellent, information is considered reliable, and no major discrepancies were found.

Air Crew Selection

Psychology

Organisation: Dr. Metz, in Berlin, was in charge of all psychology. He died in 1943 and was replaced by Dr. Kreipe, who is thought to be in Russian hands. There was a large executive and experimental centre for aircrew selection in Berlin. Each Luftgau had one or two aircrew selection centres, which were purely practical, concerned with the routine selection of aircrew. The statistics of selection were forwarded from each centre to Berlin, where a central pool existed. All the data remained in Berlin and its fate is uncertain. The psychologists were only concerned with selection and had no part in aircrew management afterwards.

Appointment of Luftwaffe psychologists began in 1935 and Gera-

thewohl was appointed the next year. On the outbreak of war there were between 30 and 40, but afterwards this increased to 120, mainly well trained whole-time psychologists. These men usually held a Ph.D. and then attended lectures in psychiatry, given by a psychiatrist in a University, for about a year. Before appointment they were also trained in Luftwaffe affairs pertaining to aircrew.

In 1942 Goering personally dismissed them and psychological selection and research ceased. This change was for political and personal reasons, including disapproval of the rejection of sons of influential men. The active officers of the Luftwaffe favoured psychological testing and Gerathewohl thought that the results of psychological selection were practically of value.

Method of Testing

Flying Aptitude: Dr. Gerathewohl is compiling a full report of the tests used and the results obtained. This will be appended to the report, and should give an accurate picture of their methods. The following comments are supplementary to that report.

Psychological testing was fully established before the outbreak of war. A battery of tests was used which took 4 to 5 days for completion. At the Hamburg centre run by Gerathewohl there were 5 psychologists, and each handled 4 or 5 men a day. The object of the screening was to test the total personality, so that they introduced tests which could be modified in order to observe the subject's response to a changing situation. They did not therefore concern themselves so much with a score as with an assessment of the result. Many of the more objective tests included records of bodily response to the situation (pulse, B.P., etc.). A large number of psychological tests were devised and whenever possible they tried to validate them against subsequent performance. These tests included coördinators, dotting tests and pursuit meters of different kinds, descriptions of which will be contained in Gerathewohl's report. The most fruitful research undertaken was that into aptitude testing in a mock cockpit, in which physiological changes as well as performance in flying were decided. The machine seemed to have been similar to the S.M.A. 3.

Personality Testing: Great stress was laid on personality testing, rather than on aptitude scores. For this they used the psychiatric approach but employed psychologists who had had some psychiatric education. This was from necessity rather than choice. Gerathewohl would have preferred to use psychiatrists, but the supply of these was quite inadequate.

The method included observation of the behaviour during the psychological tests, which led to an appraisal of performance, with a written account of the response to the test rather than a score. A full psychiatric interview was given (? in some cases), which included a personal and family history in which special attention was paid to personal reactions at work and at play, at school and afterwards. Special personality char-

acteristics were studied, in much the same way as in the R.A.F., and mood changes, lack of persistence, and timidity were mentioned on the one hand, with stability and cheerfulness on the other. A written questionnaire, Rorshach, Wartegg and Reitwort-Bedode tests were also used. I gathered that such detailed tests were only employed when there was doubt about accepting a man, and in these circumstances they also took the advice of a flight surgeon who had had some psychiatric experience.

Besides the laboratory tests - about 12 - there was psychometric testing, and testing in field sports including team games and athletics, and observation while flying.

Total Assessment: At the end of the 5 days the tester had to make an elaborate assessment. This was written as a report. It included the results of individual tests, but scores were avoided, and they relied more upon the observer's estimate of the method of performance.

The written report included:-

1. An assessment of aptitude for flying in 4 grades.
2. Judgment of aptitude for special duties, eg. fighter, bomber, photographic reconnaissance.
3. Similar judgment upon aircrew category, eg. pilot, navigator, airgunner, etc.
4. Assessment of aptitude for operational flying, transport flying, or instructing.

Results The use of tests was well worth while, but Gerathewohl thought the results of psychiatric assessment by psychologists disappointing - "If the psychologist was good, the results were good." He would have preferred to have had teams of psychologists and psychiatrists working together. The method may perhaps have been abandoned because "some of the psychologists were such bad psychiatrists."

In a controlled experiment 40 per cent of the men who had been rejected on the total battery of tests succeeded in learning to fly, compared with 95 per cent of those accepted. This battery included 10 to 12 tests and a psychiatric assessment.

A full study of this subject cannot be made without Gerathewohl's report.

Professor Luxemberger had no dealings at all with psychological selection and had no knowledge of it, for the psychiatric branch was quite separate. He thought that Dr. Gerathewohl stood high in German psychology and was mainly responsible for the methods of testing which had been used prior to 1942 in the Luftwaffe.

Psychiatric Selection

The only selection was that made by the examining doctor on intake. A physical examination was made and if time and interest permitted the medical officer asked questions about the candidate's past, and in a general way summed him up. The interview was always less than half an hour and I got the impression that it was usually cursory. An ex-instructor also asked questions at the same time. There was no experimental validation of the testing, and no attempt to follow men through flying. The interview was made by medical officers with knowledge of aircrew, who had attended a course of lectures in the Institute in Berlin run by Stuckoldt. This included elementary instruction in aircrew psychiatry. No guide to the interview was given, but it should have included a history of the man's past life and family. Selection was left to the common sense of the doctor, and psychiatrists had no say in the matter after 1942. No intelligence tests or examination of general education was used. There was no further system of selection as training proceeded and unless attention was drawn to gross unsuitability by the flying instructors no further interviews were held. Rejection on the basis of poor flying performance was fairly common.

Selection of aircrew was reasonably satisfactory until 1941, but after that the standard fell badly for two reasons:- (i) the medical officers were inferior and were badly trained, so that the interview was inadequate, (ii) the material available was inferior and the men were psychologically less robust, lacked stamina and courage, and were unsuitable for the job. These two factors were caused by the great need for new men on all fronts, a need that could not be filled satisfactorily. Evidence of the increasing unsuitability of aircrew after 1941 was provided by the increasing numbers sent back from squadrons as unsuitable, the number sent back with neuroses, or with other diagnoses cloaking neurosis, and the numbers sent back to rest homes and recuperation centres without a diagnosis of neurosis. At an estimate 30 per cent were rejected on medical grounds including 10 per cent for psychiatric reasons.

It was clear that psychiatric selection was left entirely to untrained general medical officers and that this was very unsatisfactory in its form and results. It was also clear that there was never any liaison between psychologist and psychiatrist. The first was used for selection, the second for treatment. They never saw each others work or reports.

The medical officers thought that psychological testing was abandoned because the clinical impression of good doctors upon the personality gave better results than detailed testing of special aspects of behaviour. Theoretically there should have been selection by psychiatrists but it was impracticable.

Air Crew Management

Spacing of Operational Effort: No central direction was given to the intensity of operational flying, it was left to the commanders to

conserve their crews if they could. During the Battle of Britain over-work was the rule and fatigue serious. After that the problem was not over- but under-activity, due to the great shortage of aviation spirit. There was persistent inactivity in bombing squadrons, with deterioration in efficiency, but as the war went on the fighter squadrons were so hard worked that it was impossible to release men for rest.

Leave: The standard leave for aircrew was 14 days a year, but the M.O.s could recommend leave and did so frequently. The M.O.s with the C.O.s seemed to have wide powers in this regard, and their recommendations to a large extent took the place of official policy. The C.O.s and M.O.s evidently worked together very closely. The 14 days leave was thought to be inadequate.

Operational Limit: No limit to the duration of operational flying was ever instituted. There was no interchange between duties, e.g. Operational and Instructing, and some men had remained in squadrons throughout the war. The reason given was that aviation spirit was so scarce that at the end of 1941 training establishments were reduced, and only enough men were trained to replace losses. There was consequently no profitable form of relief employment. Asked about the chances of survival in these circumstances, Professor Luxemberger said he knew nothing about that.

Leadership: It was evident throughout the interviews that the whole burden of maintaining efficiency rested on the squadron commanders. They had a liberal view of their men's problems, used the medical officers' help extensively, and had a very free hand in the management of their men. They looked for signs of deterioration in the man's appearance and behaviour and would send him on leave or to a rest camp in the Austrian Alps without hindrance.

Aircrew Neurosis

The management of neurosis in the Luftwaffe was directed from Berlin by Oberstabsarzt Professor E. R. Schultz, of the Deutsches Institut für Psychiatry - thought to be in Berlin.

Diagnosis: All through the war the diagnosis of neurosis was avoided at all costs, although there was no doubt in the consultant's mind as to the nature of the disorders and the severity of the problem. If a man could not or would not fly, he was said to have "abgeflogensein", a free contemporary translation of which is "He has had flying." The suggestion was that he had ceased to be able to carry out one particular form of duty, although he was in other respects normal. No suggestion of causation was intended. "Abgeflogensein" was used for failure to stand up to flying, whether this was the result of a neurosis or volitional.

Early in the war all cases were called abgeflogensein, for the word was coined in the belief that there were etiological causes peculiar

to flying. Junior officers still expressed the view to me that special factors such as vibration and anoxia may have a specific effect, particularly on the autonomic nervous system, and thought that a physical basis for these disorders was present though not yet demonstrated. The autonomic nervous system was blamed by several men interviewed, for the psychological changes which resulted from concussion, as well as from operational flying. Luxemberger had no illusions. He thought the name "abgeflogen-sein" and the idea behind it were unsound, because every man he saw with symptoms could be fitted into the standard nomenclature of neurosis.

He thought there was no fundamental difference between the neuroses of flying and those of civil life, although there were external differences, differences which were merely coloured by the work and the circumstances in which the neurosis had arisen. Apart from hiding behind the term "abgeflogen-sein" neuroses were often cloaked in the diagnosis of a physical disorder. This was very often deliberate, but sometimes it was due to a complete failure of the physicians to recognise the true cause of visceral disorders.

Types of Neurosis: Nearly all cases were examples of Anxiety States or anxiety with depression. Hysteria of the gross sort seen in the last war was exceptional.

Acute fear states were not common, for the disorders were usually more chronic with added visceral symptoms which were often referred to the stomach or intestinal tract. These symptoms were sometimes hysterical, although the use of this word was forbidden in relation to aircrew. The reason for this absolute rule was the suggestion that cowardice may have contributed to the disorder, for it is very difficult to make a distinction between the two.

As the word 'hysteria' was forbidden, and 'neurosis' was used as rarely as possible, there was a tendency to stress the visceral accompaniments of the mental symptoms and to use the name of an organic disease. Schütt had divided neuroses into three types:-

- 1 - Rant Neurosen - a superficial neurosis in which the personality is not deeply involved, eg. hysteria or acute fear state.
- 2 - Schlicht Neurosen - the personality is deeply involved, eg. an obsessive-compulsive state.
- 3 - Kern Neurosen - depending entirely on the basic personality, eg. psychopaths, schizoid personalities, sexual perverts.

A distinction was made between neuroses that were mainly exogenous and those occurring in a handicapped person. When predisposition to neurosis was considered severe the man was called psychopathic. Psychopaths included men who were unable to make an adequate adjustment to their environment, but whose social behaviour was normal.

Causes: Luxemberger thought that the main cause of neurosis was poor selection, which had allowed admittance of bad material. Poor personality selection led to inefficiency and many accidents in training were directly due to this.

The main exogenous cause was repeated and prolonged standing-by, particularly in fighters. Neurosis was a constant source of worry in fighters, but not bombers. There was no adequate system of standing down so that day after day they waited for allied bombers, with little respite. After a long time an attempt was made to diminish the stress of standing-by by instituting a regular day off once a week.

Incidence: There was a central machine for coordinating knowledge about psychological disorders in aircrew. Schütt in Berlin was responsible for central direction, and would be well worth interviewing. Luxemberger believed that the figures of incidence and general statistics, which were housed in Berlin, had been destroyed. They were handled by Oberstabsarzt Professor Schröder, who was in charge of this section. It was housed in the Lager Samlow-Zollan, in Berlin. I formed the view that the Luftwaffe administrators had charge of statistics and general management and that the consultants, who were really civilian experts, were employed only on the clinical aspect of the subject. Not only were all the clinicians ignorant of this side of the work, but general policy, which was uninspired and obviously out of tune, was quite at variance with the very sound psychiatric views of Luxemberger. He was throughout the interview very detached about the central machine.

Asked about his assessment of incidence, Luxemberger said that all official figures were an underestimate, because they excluded neurosis in all the heavily predisposed and all cases of neurosis masquerading as physical disease or abgeflogensein. They also excluded figures of men with undiagnosed neurosis taken off flying or sent back for a rest. Including all cases of neurosis, whether they had been recognised officially as such or not, he thought that the incidence would be about 15 per cent per annum of average strength. He thought the official recognition of neurosis would be about a third of this figure.

When pressed he admitted that neurosis was the greatest medical problem in the Luftwaffe. It was a much greater problem in the Luftwaffe than the Army. Similarly in the Navy neuroses were more common in U. Boats than surface boats. (Neurosis was a major problem in U. Boats. Professor Groetzfeld, at Bahnhofer, Berlin, was Consultant in Psychiatry to the Navy. His civilian post was Professor of Psychiatry in Kiel University and he had personally discussed the problem with Luxemberger).

Treatment: This was handicapped by failure to face up to the existence of a high incidence of neurosis. Medical officers on squadrons were mainly responsible for the management of cases in the early stages. They made a non-committal diagnosis of "abgeflogen" and prescribed a few days off flying, 14 days at home leave, or a longer period at a rest camp. This period could be extended indefinitely. There were two large rest

amps, at Germinal and Mortsel. They were really winter and summer sports camps where a strenuous athletic life was lived. The trouble was to get the men away from them - a stay of 3 or 6 months was not uncommon. Only about 40 per cent of these men ever returned to flying.

The C.O. might send the men off without consulting the M.O., but as a rule his opinion was sought.

If the Medical officer was in doubt as to diagnosis or management he would refer the case to a "Abholtungszelle." This was an observation centre where medical boards were held and where a psychiatrist sat. A report was sent back from this centre and the M.O. might continue to manage the case. If the psychiatrist thought fit the patient was admitted to the hospital in the Luftwaffe under the psychiatrist. Treatment was various and orthodox. It was no specific form, but depended on the circumstances of the case and on the leanings of the psychiatrist. Persuasion and suggestion were most common, with mild sedatives to give sleep, and sometimes rest in bed. Prolonged narcosis or insulin were not used.

The only experiment of note was that of sending men with a mild neurosis (Rant neurosis) to an experimental flak battalion in Dortmund. Here the airmen were put to work as gunners as part of their treatment. The C.O. was a lay psychotherapist who happened to be a gunnery officer. He was a sensible sort of man, and handled the men well. He thought his results were good, for in the last 6 months before defeat, during which the experiment had been running, about 50 per cent returned to flying duties.

"Lack of Moral Fibre": A moral factor in failure to fly was never considered in the Luftwaffe. I got the impression, though it was not stated directly, that as all cases were ill there could be really no moral issue. There was tacit acceptance of the view not only that members of the Luftwaffe could never have neurasthenia or hysteria, but that there would be no one who would fail in his duty. Consequently no provision of any sort was made for such a condition. Refusal or failure to fly led to transfer to a Rest Centre, but the man never lost flying status. Sometimes in consequence of this lack of positive policy epidemics of infection of a group of men occurred, and there was some difficulty in getting men away from the rest centres and back to flying. Petrol was so scarce, and for most of the time flying was such a privilege, that deviation of totals away from flying was never an important problem. Thus in any case the psychiatrist thought that lack of provision for it was justified.

Court Martial was never used for refusal to fly. Throughout the interviews the lack of central direction, with autonomy of action on the squadrons, was very evident, and the general view was that leadership had been sufficiently good to justify this policy.

Other Psychiatric Subjects

In reply to direct questioning those interviewed said that no work had been carried out on related subjects such as the psychiatric aspects

of Airsickness, syncope, fatigue or deterioration of performance at altitude.

Neurology and Neurosurgery

Neurology Informants: Oberfeldarzt Professor Hugo Spatz - Consultant Neurologist to the Luftwaffe.

Stabsarzt Dr. Richard Lindenburg - Assistant, interviewed in the Kaiser Wilhelm Institut, Munich. They had been evacuated from the same Institute in Berlin Buch in the Spring of 1943.

Neurosurgery Informants: Generalarzt Wilhelm Tönnis - Consultant Neurosurgeon to the Luftwaffe.

Stabsarzt Dr. Fischer - Assistant neurosurgeon.

Stabsarzt Ruskan - Neurology and pathology.

Dr. Buchner - Physicist, in charge of the E.E.G. under Professor Kormannller, interviewed in the Hospital centre at Bad Ischl, near Salzburg. The Luftwaffe neurological and neurosurgical beds had been evacuated from Berlin to this small town in the Austrian Alps in 1943. 2,000 beds had been available for neurosurgical cases under Tönnis in Berlin, but the accommodation at Bad Ischl was strained to the utmost and was very primitive. At the time of our visit 640 German doctors were concentrated there, under the direction of Tönnis, who was responsible for general medical administration as well as neurosurgery. By contrast Spatz in Munich had a purely academic establishment.

Organisation: Tönnis was responsible for the whole of Luftwaffe neurology and neurosurgery, but there was no real distinction in the disposal of Luftwaffe and Army cases, although the Luftwaffe had separate hospitals. The bulk of Tönnis cases (80 per cent at the time of interview) were from the Army.

Neurology with neurosurgery was distinct from psychiatry and each division had little knowledge of what the other did. Because of the personalities responsible neurosurgery was dominant, and the neurologists were chiefly interested in neuropathology.

Four mobile neurosurgical field hospitals were organised and situated on the Russian Front, between 60 and 100 kilometres behind the line. These were served with air transport and each had 3 Stork aircraft for transport of wounded. In practice there was rarely enough fuel for this, and patients were brought to the hospital from the periphery of the sector which it served by road, often in horse-drawn vehicles, and then sent back to Berlin on hospital trains.

Each hospital was self-sufficient, and constituted an experienced neurosurgeon, 2 or 3 assistants, a neurologist, ophthalmologist and

usually an aurist and faciomaxillary surgeon, as well as a Staff of fully trained sisters. There were between 6 and 12 doctors and no anaesthetist. Although the organisation and staff were Luftwaffe these institutions were chiefly occupied with army cases. This is surprising when it is considered that the army had its separate hospitals and consultants and that there was not a close collaboration between them.

The wounded men were usually referred to these hospitals by the Unit M.O.s, and if treatment was given at an intervening general hospital, only superficial clearing of the scalp was undertaken, without closure. The interval between wounding and arrival at the Neurosurgical Centre was very often 3 to 4 days. After treatment at the Mobile Neurosurgical hospitals cases went back to the huge centre of 2,000 beds at Berlin, later evacuated to Bad Ischl, near Salzburg, or to Tutzing, south of Munich, which was visited and seen to be a large rehabilitation centre, full of grossly disabled troops.

Head Injuries

Closed - Mechanism: Views on the mechanism of concussion and of the physical changes in the hemispheres resulting from head injury were similar to those generally held. Cerebral oedema is unimportant, except when it arises in special areas. There was interest for example in oedema of the uncus causing pressure on the 3rd nerve and giving traumatic mydriasis. No work had been done on the physics of concussion, but Peters in Freiburg had been producing experimental concussion in cats.

German neurologists had been making a distinction between head injuries with unconsciousness of more or less than an hour, calling the first contusion and the second commotion. Spatz disagreed and thought that if such a division were made it should be on the basis of a much milder injury, since commotion was not associated with demonstrable damage. In more severe cases the damage is mainly in the grey matter. Associated lesions seen in the hemispheres have not much to do with concussion, amnesia or unconsciousness.

Symptoms: Vasomotor instability and vertiginous attacks are probably due to brain stem damage. There was one view widely expressed, that disturbances of the vegetative nervous system give rise to many of the symptoms of the post-traumatic state. Post-traumatic attacks of vertigo were not thought to be related to epilepsy.

Traumatic anosmia is often associated with contusion of the under surface of the frontal lobes.

Treatment: This was stereotyped. There was as a routine 3 to 4 weeks bed rest, and then slowly graduated exercise with slow return to full activity. Recently rather a more radical method has been used and patients have been kept in bed for a shorter time. Very early bed exercises have been tried. These are begun as soon as the patient can co-operate, even if he is confused. When ambulant, exercises are given

under water and later in a gymnasium; finally very strenuous exercises are given in a sports field. This was thought to reduce the incidence of post-traumatic neurosis. A film showing this treatment was shown by Tönnis.

Attention was paid to rehabilitation of the disabled, both in the service and afterwards, and the rehabilitation centre at Tutzing was very large. An organisation had existed since early in the war for following up cases medically and for placing the patients in civil employment.

Post-traumatic States: The view was held that these disorders were primarily physical, but that many psychological causes also operated. There was a deviation from orthodox views in the belief that brain stem damage with consequent disturbance of vegetative functions was the main basis of the organic disorder which underlay the condition. Spatz had no evidence to support this view.

Penetrating Head Injuries: No figures of incidence were given, but 2,000 beds in Berlin were fully utilised, and other accommodation was also used when necessary.

Surgical Treatment: The chief concern in treatment was the prevention of generalized intracranial infection, which was found to originate in subdural and subarachnoid clot and damaged tissue, and which spread down the tract with formation of subdural abscesses and meningitis.

Six films shown by Tönnis of standard methods of traumatic neurosurgery gave a vivid picture of the technique recommended. These films were used in the education of young neurosurgeons. They contained nothing new, but showed a lack of respect for the local spread of infection and for the protection of surviving brain which was reflected in the results (see later). The technique was quick but crude. For instance, in making burr holes alongside a fracture, no attempt was made either to excise the grossly infected scalp wound or to protect the operation field from its infected surfaces, while suction was used with blitzkrieg vigour. Haemostasis was cursory and diathermy was not used, gauze pads and silver clips being applied to the most active bleeding points. The sucker was used continuously, but foreign bodies and bone were removed from the bottom of the brain tract with forceps, à l'accoucheur.

When clot and dead tissue had been removed the dura was closed with continuous sutures, and defects were repaired with a pedicle graft of galea swung round from the bone underlying the area of scalp wound. Before closure a large amount of sulphonamide powder was packed in with a dessert spoon, intra- and extradurally, a large folded rubber sheet drain was laid along the dura and the scalp closed over it in one layer. When sinuses were involved the dural defect was repaired at primary operation with a galea or temporal fascia graft. Similar grafts were used for delayed repair. Bone defects, if large, were repaired by tibial grafts or by insertion of "pallidone" - acrylic resin - plates.

Treatment of Infection: All cases in which there was suspicion of infection were under a War Office order retained for at least three weeks after operation. As has been said sulphonamide powder was packed into the wound. When infection was evident, but not as prophylaxis, sulphonamides were given by mouth, especially Cibazol (Hoffman La Roche) and Tibitin (Bayer) for streptococci and Eubasine for pneumococci and meningococci. Penicillin was never used.

Daily lumbar puncture with total replacement of C.S.F. by air was also employed if cells in the C.S.F. increased over 300 per cu.cm., the idea being that this stimulated formation of C.S.F., which might contain antibodies.

Results: 30,000 cases were treated in the neurosurgical hospitals, with the following general results:-

Fit for some employment	53 per cent
Required further treatment	15 "
Died	32 "

These figures were approximate and probably unreliable as organisation had become chaotic.

In 929 cases with dural penetration 310 (33.4 per cent) died, 191 of infection (generalised meningitis, abscess or encephalitis), 46 of progressively increasing intracranial pressure, 28 moribund on admission, and 45 of causes other than the head injury.

In another series of cases 225 with infection of brain wounds resulted in death in 180 (80 per cent).

This very high mortality of a third of all cases in special head injury centres with infection the cause of three quarters of all deaths was found on the Eastern and Western fronts.

It was my impression that three factors caused the high rate of infection and death.

- (a) Delay in transport to the centres - said to be due to shortage of petrol.
- (b) Faulty surgical technique.
- (c) Absence of penicillin.

Major Alexander obtained a copy of a manual on neurosurgery for use in the Luftwaffe and Army, which is self-explanatory. Preoccupation with the spread of infection is evident throughout it.

Traumatic Epilepsy: No systematic investigation had been undertaken, but Tonnis had fairly full notes of most of his cases and a satisfactory follow-up scheme had existed until recently, but now most of the notes are dispersed.

Tönnis has made a practice of excising cerebral scars. His criteria for this are the onset of epilepsy, or cessation of recovery of function in the belief that gliosis prevents neuronal recovery. The excision is when possible made widely and continued down to the ventricle. The final result is a cerebral defect with free flow of C.S.F. from ventricle to subdural space. The rationale for this procedure is the view that contact of the cut brain surface with cerebrospinal fluid prevents gliosis. Tönnis said, with no adequate data to support it, that this effected a complete cure in 75 to 80 per cent. No data on incidence or on the relationship between epilepsy and the type of injury exist, and Tönnis gave the impression of gross unreliability in scientific observation.

Dr. Buchner was questioned about the effect of this wide excision of brain substance on the E.E.G. He said that if "Krampfströhm" - bursts of fast waves taken to indicate epileptic activity - were localised to the scar, they disappeared after operation. If, as is usually the case, they extended beyond the environs of the scar, or were bilateral, no change took place. This observation is in line with our own, and is, I think reliable. It is in my view quite incompatible with a 75 per cent 'cure' of traumatic epilepsy.

Spinal Injuries

Oberarzt Schmidt had charge of a special spinal centre at Dorpat, which was evacuated, but its present position is unknown to Tönnis. No official policy upon the management of spinal injuries was circulated. In acute paraplegics a catheter was tied in for 2 weeks or more and attempts were made to establish an automatic bladder by manual expression of urine. Tidal drainage was not used and suprapubic cystotomy was uncommon. Exploration was undertaken if there was a complete block or if foreign bodies were seen in the vertebral canal by x-ray.

Peripheral Nerve Lesions

Some but not all of these cases were treated in neurosurgical hospitals and little information was obtained upon them. Nerve grafts were never used, but end to end anastomosis was attempted wherever possible. Stress was laid on maintaining fully mobile joints.

Neuropathology

An elaborate organisation existed for the collection of pathological material. An autopsy was performed on every available cadaver in the Luftwaffe and Army. Selected specimens, including the brain in every case and the cord in some were sent back from the fronts to Berlin in special aluminium containers. The neurological material was handled by Professor Spatz in Berlin Buch. Fairly full clinical and gross pathological notes on over 2,000 cases of head injury are available at the Kaiser Wilhelm Institut in Munich, but all the pathological specimens, mostly uncut but fixed in formal saline, have been left behind in Berlin. Their fate is unknown. There appeared to have been uninspired routine collec-

tion of material, which was unlikely to lead to any significant increase in knowledge in morbid anatomy. No other original work of any moment, experimental or clinical, appears to have been organised, and little beyond the routine care of the wounded has been achieved. Even this fell far below our own standards.

Spatz's demonstration of his pathological work was interesting, but its interest is largely historical. There has been much attention to methods of spread of infection from the contaminated exposed brain. Local infection was the rule, and subdural and subarachnoid pus very common, but fatal diffuse infection caused by spread down the tract, into the ventricles, to the base and so over the convexity was also common and had led to much histological study. This pathological material, the appalling mortality, and the very high incidence of brain infection on all fronts and in all hospitals made it clear that their neurosurgical practice was far behind that in England and America.

Conclusion

All information obtained upon Luftwaffe neurology, neurosurgery and psychiatry was of historical interest only. Nothing new or of practical value was seen. The Germans in this field seem to have lived from hand to mouth and to have made little attempt at investigation and critical planning. In physical matters they were hampered by bad technique, utter complacency and almost complete ignorance of the literature in English, which led for instance to failure to use penicillin. In psychiatry a rational application of accepted principles was made impossible by the official policy of refusing to admit the existence of neurosis, or its precursors in the Herrenvolk. Psychology ceased to play any part in the Luftwaffe after 1942 for the same reason. I am not in a position to assess the work before that date. I have read Major G. E. Smyth's comments on Dr. Tönnis, and concur with them.

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